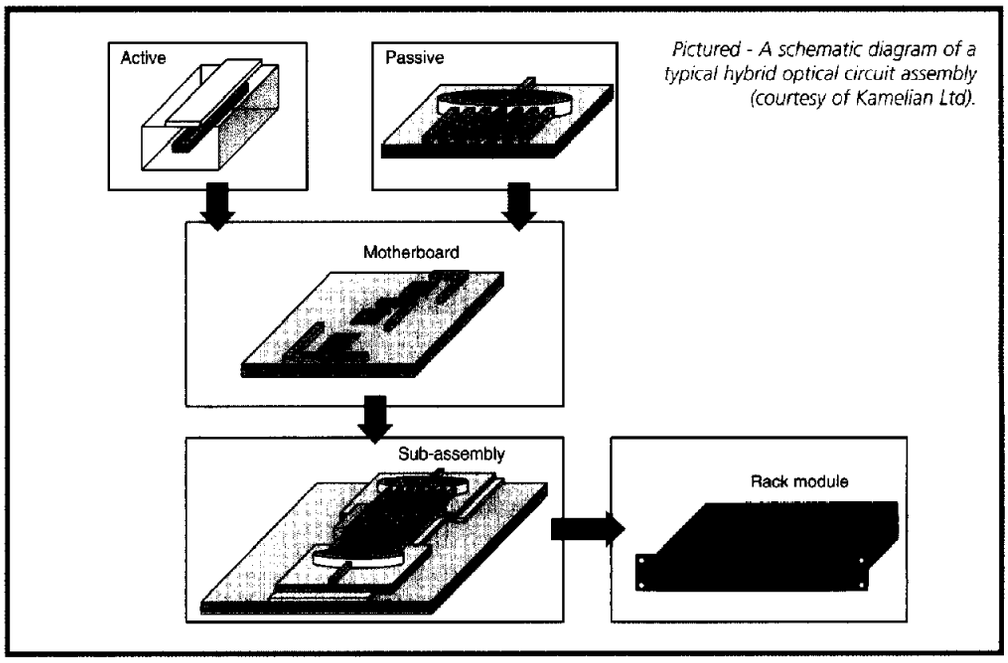
Hybrids to boost integrated optical circuits from US$13.4m to US$2.6bn by 2005

For many years the optical components industry has been researching how to build integrated optical circuits similar to those manufactured by the microelectronics industry. Now, due to a combination of new markets - such as broadband access and metro area networks - and new manufacturing strategies, the integrated optical circuit market is due to grow from just US$13.4m in 2001 to US$2.6bn by 2005 (see Table), according to the report "*The Market for Integrated Optical Products: 2001-2005*" from optical networking and components consulting firm **Communications Industry Researchers** (Tel: +1-804-984-0245; www.cir-inc.com).

A major barrier to integrated optical circuits is disappearing since "*the optical components industry is abandoning the 'pure' (but hard-to-achieve) vision of monolithic optical ICs on a single chip*" and instead adopting a "*more pragmatic vision of hybrid optical circuits in which single-function chips will be bonded together within one package*" (see schematic Figure).

The market for integrated transmitters and transceivers will be US$1.6bn by 2005. Also, although integrated modulators and lasers are not a new concept, more complex products (such as the integrated laser and wavelength locker recently introduced by **Alcatel**, and more integration of optics and electronics in transmitters and transceivers, where **Agere** will shine) will increase penetration in the marketplace.

Integrated passive DWDM products will account for US$103m in sales by 2005, mostly Arrayed Waveguide Gratings (AWG) and Variable Optical Attenuator (VOA) combinations (such as those made by **JDS Uniphase**, **Lightwave Microsystems**, and **Zenastra**).



Pictured - A schematic diagram of a typical hybrid optical circuit assembly (courtesy of Kamelian Ltd).

Embedded optical monitoring devices (an emerging requirement for integrated optical monitors, already supplied by **AXSUN** and **Bookham**) will reach US$150m by 2005.

A range of "novel" products (only possible with the integration of optical components) will emerge and account for almost US$500m in sales, including "telephotonics" suppliers using optical integration to produce a combination tunable Optical Add-Drop Multiplexer (OADM) and Integrated Optical Channel Monitor.

Although no one believes that optical integration will ever be based on one material in the way that microelectronics is based on silicon, InP is really the only material being worked with today (for example by **Agere Systems**, **Gemfire**, **Genoa** and **ThreeFive Photonics**) from which optical circuitry with many different kinds of optical functionality can be built. Revenues from InP-based products could reach US$1.1bn by 2005. (Although success in InP is not guaranteed, as exemplified by the bankruptcy of photonic integrated circuit developer **Nanovation Technologies** (Northville Township, MI, USA), after a funding round failed in July.)

Although the current value of the integrated optics market is small, seizing the opportunities that it will offer in a few years may require early entry for two reasons:

- Yields for integrated optical components are extremely low (20% in some cases) so unit manufacturing cost is high. Achieving better yields will be key to gain a competitive advantage. However, as the microelectronics industry has demonstrated, significant yield improvements come only from lengthy manufacturing experience (favouring earlier entrants).
- Although revenues will not be significant until 2003, beneficiaries will be those that are working now to achieve design wins from major equipment vendors. The lead time from targeting an equipment vendor as a likely customer to when the equipment vendor ships the product can be as long as two years.

Table. The market for integrated optical components (US$m).

	2001	2005
Transmitters and transceivers	5.4	1617.8
Passive DWDM products	0.8	102.9
Switches	0.8	77.2
Amplifiers	3.5	128.6
Monitors	1.2	150.0
Back-plane applications	1	50
Other	0.7	498.8
TOTAL	13.4	2625.3